PATENT ABSTRACTS OF JAPAN

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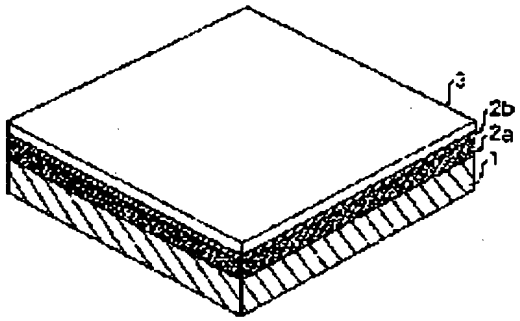
(54) MAGNETIC SHIELD AND ITS MANUFACTURE

(57)Abstract:
PURPOSE: To make a superconductive substance layer in true form of a thick film and accomplish an excellent shield characteristics by interposing an intermediate layer of Ag or Ag alloy between a base board and the superconductive substance layer as magnetic shield layer.
CONSTITUTION: A shield used in a magnetic shield wall is composed of a base board 1 as a strength member, an intermediate layer 2 (2a, 2b) laid on the surface of the base board 1, and a superconductive substance layer 3 in the form of a thick film covering the surface of the intermediate layer 2. The base board 1 is made of nickel, which excels in the anti-acid property and heat resistance. The intermediate layer 2 consists of a member 2a formed from Ag paste through baking and another member 2b formed thereover from an Ag foil attached thereto. The superconductive substance layer 3 is made of an oxide type superconductor of Bi series, formed by applying superconductive paste to the intermediate layer member 2b in the form of a thick film, followed by a baking process. This superconductive paste is prepared by dispersing a Bi series superconductive substance powder uniformly in a vehicle made from an organic solvent and ethyl cellurose.



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CLAIMS

[Claim(s)]
[Claim 1] The magnetic-shielding object which is a magnetic-shielding object which covered the superconductor layer used for the substrate as a member on the strength as a magnetic-shielding layer, and is characterized by considering as the laminated structure which made the interlayer by Ag or Ag alloy intervene between said substrates and superconductor layers.
[Claim 2] The magnetic-shielding object according to claim 1 characterized by using said interlayer as the sintering layer of Ag or Ag alloy.
[Claim 3] The magnetic-shielding object according to claim 1 characterized by considering as the structure equipped with the foil of Ag by which the laminating was carried out in said interlayer on the sintering layer of Ag by which the laminating was carried out on said substrate, or Ag alloy, and this sintering layer, or Ag alloy.
[Claim 4] It is the manufacture approach of the magnetic-shielding object characterized by being the manufacture approach of the magnetic-shielding object for acquiring a magnetic-shielding object according to claim 2, and for said interlayer forming by carrying out baking processing after applying Ag paste or Ag alloy paste on a substrate, and forming a superconductor layer by carrying out baking processing after applying a superconduction paste on said interlayer.
[Claim 5] It is the manufacture approach of the magnetic-shielding object for acquiring a magnetic-shielding object according to claim 3. Said interlayer The foil by Ag or Ag alloy is stuck on the spreading film after applying Ag paste or Ag alloy paste on a substrate, and it forms by carrying out baking processing after that. A superconductor layer The manufacture approach of the magnetic-shielding object characterized by forming by carrying out baking processing of the superconduction paste after applying on said interlayer.
[Claim 6] It is the manufacture approach of the magnetic-shielding object for acquiring a magnetic-shielding object according to claim 3. Said interlayer The sintering layer by Ag or Ag alloy is formed by carrying out baking processing of Ag paste or the Ag alloy paste, after applying on a substrate. Furthermore, Ag paste or Ag alloy paste is applied on this sintering layer. It is the manufacture approach of the magnetic-shielding object characterized by sticking the foil by Ag or Ag alloy on the spreading film, forming by carrying out baking processing after that, and forming a superconductor layer by carrying out baking processing after applying a superconduction paste on said interlayer.
[Claim 7] The magnetic-shielding object which is a magnetic-shielding object which covered the superconductor layer used for the substrate as a member on the strength as a magnetic-shielding layer, and is characterized by considering as the laminated structure which made the interlayer by Cu or Cu alloy intervene between said substrates and superconductor layers.
[Claim 8] It is the manufacture approach of the magnetic-shielding object characterized by being the manufacture approach of the magnetic-shielding object for acquiring a magnetic-shielding object according to claim 7, and for said interlayer forming by carrying out baking processing after applying Cu paste or Cu alloy paste on a substrate, and forming a superconductor layer by carrying out baking processing after applying a superconduction paste on said interlayer.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the manufacture approach at the magnetic-shielding object list which covered the superconductor layer used for the substrate as a member on the strength as a magnetic-shielding layer in detail about the manufacture approach at the magnetic-shielding object list used as a magnetic-shielding wall which forms magnetic-shielding space.
[0002]
[Description of the Prior Art] The magnetic-shielding object which used the ingredients (for example, a permalloy, mu-Metal, etc.) of high permeability as a wallplate which forms the magnetic-shielding space used as magnetic shield room has so far been developed variously.
[0003] However, with the magnetic-shielding object which used such high permeability materials, since the permeability in an ingredient is limited, even if it makes it multiplex magnetic-shielding box-frame construction, perfect magnetic-shielding space cannot be obtained. And there was a problem that the magnetic shield room itself carried out Oshige quantification, by considering as multiplex magnetic-shielding box-frame construction.
[0004] So, recently, constituting with a superconductor the magnetic-shielding wall which forms magnetic-shielding space from a viewpoint of lightweight-izing of magnetic shield room is studied. Since magnetic flux does not invade in a superconducting state, on the theory, it is because it becomes possible to acquire the high shielding effectiveness in which an internal magnetic field is set to 0, also by one-fold magnetic-shielding box-frame construction in forming a closed space with the magnetic-shielding wall made from a superconductor.
[0005] By the way, recently, the thing of the structure which covered the superconductor layer used for this substrate as a magnetic-shielding layer came to be studied as a magnetic-shielding object used as a magnetic-shielding wall made from a superconductor, using a metal substrate as a member on the strength.
[0006] Generally, when a superconductor was used as a magnetic-shielding wall of magnetic shield room, production of magnetic large-sized shield room was made difficult from many problems in the moldability of a superconductor, machinability, a mechanical strength, etc. However, problems, such as structure which covered the superconductor layer as mentioned above on the metal substrate which is a member on the strength about the magnetic-shielding object using a superconductor, then a mechanical strength, are solved, and it is thought that production of magnetic large-sized shield room also becomes easy. In addition, it is thought that the thing excellent in acid resistance and thermal resistance, such as nickel (nickel) or stainless steel (SUS), is good as a metallic material used for said substrate.
[0007]
[Problem(s) to be Solved by the Invention] By the way, although how to apply a superconduction paste (what the predetermined solvent etc. was made to distribute superconductor powder to homogeneity, and was made into the shape of half-liquid) as an approach of covering a superconductor layer on a metal substrate, calcinate this spreading film at predetermined temperature, and use as a superconductor layer can be considered In order to stabilize the

superconduction property in a superconductor layer, it is desirable to fabricate said superconductor layer in the shape of [a certain amount of] a thick film.

[0008] However, if the bond strength of a substrate and a superconductor layer is low and considers a superconductor layer as thick-film-ized use when a superconductor layer is formed on substrates, such as the above-mentioned nickel and stainless steel the effect of the difference of the coefficient of thermal expansion of a substrate and a superconductor layer etc. -- it is -- there was a problem that it became difficult to be easy to produce exfoliation, and for thick-film-ization to become very difficult, consequently to aim at the stabilization and improvement in a superconduction property in a superconductor layer.

[0009] Moreover, when a superconductor layer was formed on substrates, such as nickel and stainless steel, those substrate ingredients and superconductor layers reacted, for example, nickel was spread in the superconductor layer, and there was also a problem of a superconduction property having become unstable or falling.

[0010] This invention was made in view of said situation, can attain thick-film-ization of a superconductor layer, and, moreover, aims at providing with the manufacture approach of the magnetic-shielding object offering the magnetic-shielding object which can expect to acquire the shielding property which the superconduction property in a superconductor layer did not fall by diffusion of a substrate ingredient etc., and was excellent, and a list.

[0011]

[Means for Solving the Problem] A magnetic-shielding object according to claim 1 is the thing of the format which covers the superconductor layer used for the substrate as a member on the strength as a magnetic-shielding layer, and is making the laminated structure which made the interlayer by Ag or Ag alloy intervene between said substrates and superconductor layers.

[0012] A magnetic-shielding object according to claim 2 uses the interlayer in a magnetic-shielding object according to claim 1 as the sintering layer of Ag or Ag alloy.

[0013] The magnetic-shielding object according to claim 3 is made into the structure equipped with the foil of Ag by which the laminating was carried out in the interlayer of a magnetic-shielding object according to claim 1 on the sintering layer of Ag by which the laminating was carried out on said substrate, or Ag alloy, and this sintering layer, or Ag alloy.

[0014] The manufacture approach of a magnetic-shielding object according to claim 4 is for acquiring a magnetic-shielding object according to claim 2, said interlayer forms by carrying out baking processing, after applying Ag paste or Ag alloy paste on a substrate, and a superconductor layer is formed by carrying out baking processing, after applying a superconduction paste on said interlayer.

[0015] The manufacture approach of a magnetic-shielding object according to claim 5 It is for acquiring a magnetic-shielding object according to claim 3. Said interlayer The foil by Ag or Ag alloy is stuck on the spreading film after applying Ag paste or Ag alloy paste on a substrate, it forms by carrying out baking processing after that, and a superconductor layer is formed by carrying out baking processing, after applying a superconduction paste on said interlayer.

[0016] The manufacture approach of a magnetic-shielding object according to claim 6 It is for acquiring a magnetic-shielding object according to claim 3. Said interlayer The sintering layer by Ag or Ag alloy is formed by carrying out baking processing of Ag paste or the Ag alloy paste, after applying on a substrate. Furthermore, Ag paste or Ag alloy paste is applied on this sintering layer, the foil by Ag or Ag alloy is stuck on that spreading film, and it forms by carrying out baking processing after that. Moreover, a superconductor layer is formed by carrying out baking processing of the superconduction paste, after applying on said interlayer.

[0017] A magnetic-shielding object according to claim 7 is the thing of the format which covered the superconductor layer used for the substrate as a member on the strength as a magnetic-shielding layer, and is made into the laminated structure which made the interlayer by Cu or Cu alloy intervene between said substrates and superconductor layers.

[0018] The manufacture approach of a magnetic-shielding object according to claim 8 is for acquiring a magnetic-shielding object according to claim 7, and said interlayer forms by carrying out baking processing, after applying Cu paste or Cu alloy paste on a substrate. Moreover, a superconductor layer is formed by carrying out baking processing of the superconduction paste,

after applying on said interlayer.
[Function] With the magnetic-shielding object concerning this invention, by having considered as the structure where the interlayer was made to intervene between a substrate and a superconductor layer, the bond strength of a superconductor layer increases, therefore exfoliation of a superconductor layer does not occur, but the superconduction property of a superconductor layer can be stabilized by attaining thick-film-ization of a superconductor layer, and the shielding property at the time of using it as a magnetic-shielding wall can be raised. And the diffusion to the superconductor layer of nickel will also be lost by mediation of a superconductor layer, and the depression of the superconductor layer by diffusion of a substrate ingredient can also be prevented.
[0019] moreover, the thing for which the magnetic-shielding object applied to this invention by this by common use of a manufacturing facility and a standardization of an activity becoming easy by the manufacture approach of the magnetic-shielding object concerning this invention in order to form each of interlayers and superconductor layers by the same baking processing is produced efficiently -- things become possible.
[0020]
[Example] Drawing 1 shows the structure of one example of the magnetic-shielding object concerning this invention. The magnetic-shielding object of this one example is used for the magnetic-shielding wall of magnetic shield room etc., and the front face of the substrate 1 as a member on the strength, the interlayer 2 by whom the laminating was done to the front face of this substrate 1, and this interlayer 2 consists of wrap thick-film-like superconductor layers 3.
[0021] It is the plate made from nickel which is the metal said substrate 1 excelled [metal] in acid resistance or thermal resistance here. Moreover, in the case of this example, the interlayer 2 consists of the 2nd interlayer 2b by the foil of Ag stuck on 1st interlayer 2a formed by calcinating Ag paste, and this 1st interlayer 2a.
[0022] In addition, said Ag paste is manufactured liquefied by distributing homogeneity in the vehicle which made Ag powder by the organic solvent and ethyl cellulose. First, manufacture of said interlayer 2 generates 1st interlayer 2a by calcinating at 900 degrees C for 2 hours, after making the thickness of 50-100 micrometers apply and dry Ag paste on said substrate 1. And the further above-mentioned Ag paste is applied on 1st interlayer 2a, Ag foil whose thickness dimension is about 50 micrometers is stuck on the spreading film, and 2nd interlayer 2b is generated by calcinating at 900 degrees C.
[0023] In the case of this one example, said superconductor layers 3 are the oxides superconductors of Bi system 2212 phase. This superconductor layer 3 applies a superconduction paste 50-200 micrometers in the shape of a thick film on said 2nd interlayer 2b, and is formed by carrying out baking processing after spreading.
[0024] In addition, in the case of this one example, said superconduction paste is manufactured liquefied by distributing homogeneity in the vehicle which made the superconductor powder of Bi system 2212 phase by the organic solvent and ethyl cellulose.
[0025] In the case where the superconductor thick film of direct Bi system 2212 phase is formed on the substrate of nickel, there was un-arranging [that the shielding property at the time of exfoliation of a superconductor layer having been seen in some places, and nickel being spread in a superconductor layer, and the superconduction property in a superconductor layer deteriorating, consequently using it as a magnetic-shielding object deteriorated].
[0026] However, exfoliation of a superconductor layer does not occur, but in the case of the magnetic-shielding object of the one above-mentioned example, the superconduction property of a superconductor layer can be stabilized by attaining thick-film-ization of a superconductor layer, and it can raise the shielding property at the time of using it as a magnetic-shielding wall. And there is also no diffusion to the superconductor layer of nickel, and it was also checked that the depression of the superconductor layer by diffusion of a substrate ingredient does not arise.
[0027] moreover, the thing for which the magnetic-shielding object applied to this invention by this by common use of a manufacturing facility and a standardization of an activity becoming easy in manufacture of the magnetic-shielding object of said one example in order for each to form an interlayer 2 and the superconductor layer 3 by the same baking processing is produced

efficiently -- things become possible.
[0028] In addition, nickel was used for the ingredient of the substrate with which a superconductor layer is covered in each above-mentioned example. However, according to an invention-in-this-application person's etc. research, metals, such as stainless steel, can also be used for the metallic material as a substrate, for example that what is necessary is just to excel in acid resistance or thermal resistance.
[0029] Moreover, in said one example, as an ingredient of the interlayer who makes it intervene between a substrate and a superconductor layer, although the case of Ag was shown, an interlayer's ingredient can also be used as Ag alloy, copper, or a copper alloy. Moreover, as an interlayer, in forming the sintering layer of Ag alloy, Ag alloy paste is used instead of the above-mentioned Ag paste, and it forms by calcinating the applied paste at predetermined temperature according to the procedure of the interlayer formation in one example. As an interlayer, the paste to be used only replaces and the procedure is also the same as when forming a copper sintering layer, or when forming the sintering layer of a copper alloy.
[0030] Moreover, it manufactures liquefied by making homogeneity distribute any paste of a metal in the vehicle which made the powder of the metal by the organic solvent and ethyl cellulose. Therefore, the production process etc. is the same even if the metallic material used for an interlayer replaces.
[0031] Moreover, in the case of one example, the interlayer 2 consisted of the 1st interlayer 2a which is a sintering layer, and the 2nd interlayer 2b which used the foil, but even if it omitted 2nd interlayer 2b, the diffusion to the superconductor layer 3 of the ingredient of a substrate 1 could be prevented, and inconvenient generating of exfoliation of the superconductor layer 3 etc. was also able to be prevented. Therefore, 2nd interlayer 2b is omitted and it also becomes possible to attain low cost-ization by reduction of the routing counter of the part. However, when 2nd [using a foil] interlayer 2b is used, a plane of composition with the superconductor layer 3 becomes smooth, and when stabilizing and raising the property of the superconductor layer 3 by equalization of the thickness of the superconductor layer 3 etc., there is an advantage.
[0032] Moreover, in the one example, as a superconductor used for a superconductor layer, although Bi system oxides superconductors were shown, the superconductor used for a superconductor layer is not limited to the thing of one example. However, it is desirable for what has high critical temperature to use the oxides superconductors of Y system and Tl system preferably practically except the above-mentioned Bi system.
[0033]
[Effect of the Invention] With the magnetic-shielding object concerning this invention, by having considered as the structure where the interlayer was made to intervene between a substrate and a superconductor layer, the bond strength of a superconductor layer increases, therefore exfoliation of a superconductor layer does not occur, but the superconduction property of a superconductor layer can be stabilized by attaining thick-film-ization of a superconductor layer, and the shielding property at the time of using it as a magnetic-shielding wall can be raised. And the diffusion to the superconductor layer of nickel will also be lost by mediation of a superconductor layer, and the depression of the superconductor layer by diffusion of a substrate ingredient can also be prevented.
[0034] moreover, the thing for which the magnetic-shielding object applied to this invention by this by common use of a manufacturing facility and a standardization of an activity becoming easy by the manufacture approach of the magnetic-shielding object concerning this invention in order to form each of interlayers and superconductor layers by the same baking processing is produced efficiently -- things become possible.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of one example of the magnetic-shielding object concerning this invention.
[Description of Notations]
1 Substrate
2 Interlayer
2a The 1st interlayer
2b The 2nd interlayer
3 Superconductor Layer

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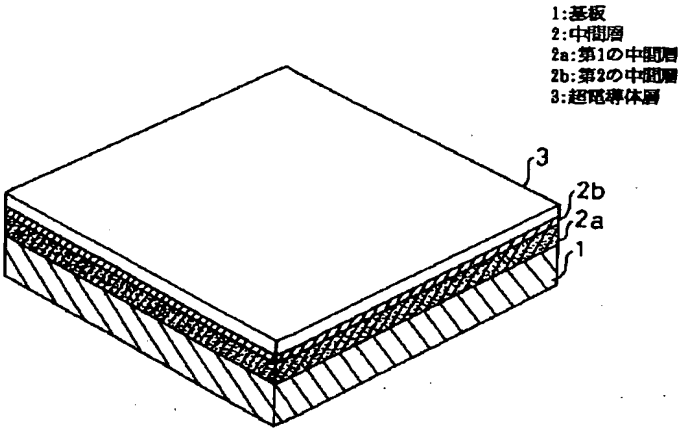
DRAWINGS

[Drawing 1]



本発明に係る酸気ｼｰﾙﾄﾞ体の一実施例の構成図

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